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[RECORD OF SUBMITTED ITEMS]

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[Name of Document] Specification

[Name of the Invention] Partitioned Scanning Optical Device

[Scope of Patent Claims]

[Claim 1]

A partitioned scanning optical device equipped with multiple partitioned scanning parts that scan within a partitioned region, partitioned by primary scanning regions, that performs exposure of one primary scanning part to scan simultaneously using these multiple partitioned scanning parts, comprising:

an image data partitioning means that partitions into individual partitioned image data, which will be exposed individually by each partitioned scanning part, the image data that is to be exposed onto the surface to be scanned, where there are overlapping regions wherein the same part can be exposed in the scanning region of said partitioned scanning parts;

multiple memory means that store each of said partitioned image data;

multiple address specification means that specify the respective memory addresses of said memory means; and

a memory operation control means that controls the memory operation of said memory means so that the partitioning positions of said image data will be in the respective overlapping regions of the multiple memory means specified by said address specification means.

[Claim 2]

A partitioned scanning optical device according to Claim 1, comprising a timing change means that changes the partitioning timing according to said memory operation control means each time there is one primary scan, or each time there are multiple primary scans.

[Claim 3]

A partitioned scanning optical device according to Claim 1 or Claim 2, further comprising an image data de-assertion means that outputs a dummy signal, which is a light source non-emission signal, relative to addresses within the range of said overlapping regions specified by said address specification means in the memory means except for the memory means that stores the image data.

[Claim 4]

A partitioned scanning optical device according to Claim 3, wherein, prior to said data partitioning, image partitioning memory operations are performed by said image data de-assertion means using the image data corresponding to said dummy signals as the boundaries when the image data corresponding to said dummy signals are detected.

[Claim 5]

A partitioned scanning optical device according to Claim 1 or Claim 2, wherein said memory operation control means is a memory operation switching means that stops the memory operation to the memory means of the partitioned image data A and switches to the memory operation to the memory means of the partitioned image data B (with two partitioned image data for a single said

overlapping region defined as partitioned image data A and partitioned image data B), when both the address specification means that controls the memory operation of the memory means for the aforementioned partitioned image data A and the address specification means that controls the memory operation of the memory means for the aforementioned partitioned image data B are operating.

[Detailed Explanation of the Invention]

[0001]
[Area of Technology Containing the Invention]
The present invention relates to scanning optical devices used in image recording devices, such as laser printers or digital copiers, that record images through scanning exposure of a laser beam onto a photosensitive element according to image data, and, more specifically, relates to partitioned scanning optical devices wherein the surfaces to be scanned are partitioned and scanned by multiple laser beams.

[0002]
[Prior Art and Problems Solved by the Present Invention]
In recent years, with advances in networking technologies and increasingly high-performance computers, there has been the need to have high-speed and high-resolution graphics outputs in the image recording devices, such as laser printers and digital copiers, which are the output devices for these advanced networking technologies and high-performance computers. As described in Japanese Unexamined Patent Application Publication S54-128352 (hereinafter termed "Prior Art 1"), and Japanese Unexamined Patent Application Publication H6-255169 (hereinafter termed "Prior Art 2"), there have been, in addition to technologies that increase the speed of rotation of polygonal mirrors, proposals for partitioned scanning optical devices that attempt to increase the scanning speeds, without increasing the speed of rotation of the polygonal mirrors, through the use of multiple light sources and through the formation of a single primary scan line from multiple partitioned scan lines, as a way to fulfill the requirements for high-speed and high-resolution.

[0003] In the partitioned scanning optical devices described above, it is difficult to adjust precisely the positions between the partitioned scan lines to the desired positions, and in order to obtain a desirable up image, it has been necessary to correct the output starts timing of the image data according to the position between the partitioned scan lines.

[0004] When it comes to primary scanning direction, the output timing correction is done through increasing or decreasing the amount of delay from the horizontal synchronization signal to the image data output start, and when it comes to the secondary scanning direction, it has been necessary to change the image data output starts timing in horizontal synchronization signal units according to the amount of shift in the position in the secondary scan direction between the partitioned scan lines.

[0005] Figure 10 shows a timing chart for the amount of shift between the partitioned scan lines in the secondary scan direction and the image data output start timing.

[0006] In Figure 10, the amount of shift in the position in the secondary scan direction of the partitioned scan line A and the partitioned scan line B is three lines worth. Because of this, the partitioned image data write out timing requires that the partitioned image data A be delayed three lines worth relative to the partitioned image data B so that there will be alignment in the positions in the secondary scan direction of the image data on the photosensitive element.

[0007] In the aforementioned Prior Art 1 and Prior Art 2, there are claims regarding correcting the positions in the primary scan direction, but no consideration is given to positional shifts in the secondary scan direction.

[0008] Furthermore, if there is, in the partitioned scanning optical devices, a small amount of partitioned scan line misalignment that cannot be corrected, there will be disruption to the image in the places wherein the image is formed by each of the partitioned scan lines joined together. In order to suppress any reduction in image quality resulting from these disruptions, it is necessary to change the timing of the partitioned image [data] for each primary scan, necessary to perform processes for joining together the partitioned images at positions in the image data corresponding to light source non-emission signals, and so forth, so that the joining positions of the images in the primary scan direction are not lined up [with each other].

[0009] When these types of processes are performed by partitioned scanning optical devices wherein there is a shift in the partitioned scan line positions in the secondary scanning direction, then, as shown in Figure 10, the image information written onto the photosensitive element for the one primary scan line by the respective partitioned scan lines will have a different writing position in the secondary scan direction, and so the partitioned positions for the respective image data will be different.

[0010] Because of this, there is a need to delay the partitioning position data relative to the shift in the position of the partitioned scan line in the secondary scan direction when reading out the partitioned image data, with a problem in that this complicates the circuit structure.

[0011] In consideration of the situation described above, the object of the present invention is to provide a partitioned scanning exposure device capable of correcting for positional shifts in the partitioned scan lines in the secondary scanning direction, and capable of changing the image data partitioning positions, doing so with a simple circuit structure.

[0012]
[Means for Solving the Problem]
The invention according to Claim 1 is a partitioned scanning optical device equipped with multiple partitioned scanning parts that scan within a partitioned region, partitioned by primary scanning regions, that performs exposure of one primary scanning part to scan simultaneously using these multiple partitioned scanning parts, comprising an image data partitioning means that partitions into individual partitioned image data, which will be exposed individually, by each partitioned scanning part, the image data that is to be exposed onto the surface to be scanned, where there are overlapping regions wherein the same part can be exposed in the scanning region of said partitioned scanning parts, multiple memory means that store each of said partitioned image data, multiple address specification means that specify the respective memory addresses of said memory means, and a memory operation control means that controls the memory operation of said memory means so that the partitioning locations of said image data will be in the respective overlapping regions of the multiple memory means specified by said address specification means.

[0013] Given the invention according to Claim 1, it is possible to select the partitioning positions freely because the image data is partitioned through the performance of a memory operation control means within a range of addresses in an overlapping region, after making it possible to store, in an address specification means, the overlapping of the partitioned image data with mutually adjacent memory addresses stored in the memory means.

[0014] The invention according to Claim 2 is a partitioned scanning optical device according to Claim 1, comprising a timing change means that changes the partitioning timing according to

said memory operation control means each time there is one primary scan, or each time there are multiple primary scans.

[0015] In this invention according to Claim 2, when one considers the final image, it looks a lot better to have the line of joints in the partitioned positions in the primary scan to be at an angle or to change at random, rather than being lined up straight up-and-down. Because of this, it is possible to increase the quality of the final image by changing the switchover timing of the memory operation switching means every one primary scan or multiple primary scans.

[0016] The invention according to Claim 3 is a partitioned scanning optical device according to Claim 1 or Claim 2, further comprising an image data de-assertion means that outputs a dummy signal, which is a light source non-emission signal, relative to addresses within the range of said overlapping regions specified by said address specification means in the memory means except for the memory means that stores the image data.

[0017] Given the invention according to Claim 3, a dummy signal is stored in the addresses in the range of the overlapping regions in a memory means that is not the memory means that stores the image data. Because of this, not only is it possible to change freely the partitioning positions in the column direction, or in other words, in the primary scan direction, based on the assertion of this dummy signal, but the partitioning position can be changed easily for each line based on the number of dummy signals.

[0018] Furthermore, because, in terms of control, it appears as though the partitioning is always done in the same partitioning position, there is no need to have feedback control regarding shift in the feed direction, or in other words, in the secondary scan direction, and all that must be done is to correct for the amount of shift.

[0019] The invention according to Claim 4 is a partitioned scanning optical device according to Claim 3, wherein, prior to said data partitioning, image partitioning memory operations are performed by said image data de-assertion means using the image data corresponding to said dummy signals as the boundaries when the image data corresponding to said dummy signals are detected.

[0020] Given the invention according to Claim 4, when the partitioning position is selected, if there is data wherein the light source is not emitted, or in other words, for example, if there is image data wherein the output of the laser beam is OFF, in the case wherein the image is formed using a laser beam, the use of this position as the partitioning position makes it possible to minimize the reduction in quality due to the partitioned scanning.

[0021] The invention according to Claim 5 is a partitioned scanning optical device according to Claim 1 or Claim 2, wherein said memory operation control means is a memory operation switching means that stops the memory operation to the memory means of the partitioned image data A and switches to the memory operation to the memory means of the partitioned image data B (with two partitioned image data for a single said overlapping regions defined as partitioned image data A and partitioned image data B), when both the address specification means that controls the memory operation of the memory means for the aforementioned partitioned image data A and the address specification means that controls the memory operation of the memory means for the aforementioned partitioned image data B are operating.

[0022] Given the invention according to Claim 5, the image data for a given overlapping region can be stored in both the partitioned image data A and the partitioned image data B, and when

there are multiple partitioning positions, adjacent partitioning positions can be considered individually.

[0023] At least, it becomes possible to obtain a region wherein the image data for the overlapping regions can be stored into memory devices by starting the operation of both address specification means, which control the memory operations for both of the memory means for the partitioned image data A and the partitioned image data B for the image data of the overlapping region.

[0024] Consequently, if, while both address specification means are both operating, then, at any time, the memory operation for the memory means for the partitioned image data A can be stopped, and can be switched over to the memory operation for the memory means for the partitioned image data B. Note that, in the aforementioned memory operation switching means, the function that stops the memory operation for the memory means for the partitioned image data A and the function for switching to the memory means for the partitioned image data B are not constrained to be one after the other temporally.

[0025]
[Example Embodiments the Present Invention]
[First Example Embodiment]
Figure 1 shows a partitioned scanning optical device 100 according to a first example embodiment of the present invention.

[0026] The partitioned scanning optical device 100 is applied as a laser printer optical device. A photoreceiver element 102 is equipped within the partitioned scanning optical device 100.

[0027] [The structure is such that] the horizontal synchronization signal is outputted from this photoreceiver element 102, and, based on this horizontal synchronization signal, the image data signal is outputted to a partitioning means 106 from a laser printer control unit 104. Light sources 108 and 110 are modulated based on the image data signal, and the modulated light beams are guided to a photosensitive element 112, in a structure wherein this photosensitive element 112 is exposed to light.

[0028] The light sources 108 and 110 are laser diodes, where the beams emitted from these light sources 108 and 110 are shaped by the optics groups 114 and 116, and are caused by mirrors 118 and 120 to be incident on the reflective mirror surfaces of a polygonal mirror 122.

[0029] This polygonal mirror 122 is rotated at a high speed at a constant angular velocity, where the beam the reflected from the reflective mirror surfaces of this polygonal mirror 122 undergoes f-θ correction in an optics group 124 equipped with a function as an F-θ lens. The beam that passes to this optics group 124 is then reflected by a mirror 126, and by mirror is 128 and 130 to be guided to the aforementioned photosensitive element 112.

[0030] The partitioned scan lines 132 and 134 on the aforementioned photosensitive element 112 have some positional shift in the secondary scanning direction. This is the positional shift of the partitioned scan lines that remains after adjustment by the optical devices, where it is difficult to completely eliminate the shift, where, in mechanical adjustments, there will be a remaining shift in the order of tens of microns to hundreds of microns.

[0031] In relation to this partitioned scanning optics device 100, the image data signals that are outputted sequentially from the laser printer control unit 104 according to the horizontal synchronization signals are converted into partitioned image data, according to the partitioned

scanning, in the partitioning circuit 106, and are outputted to the partitioned scanning optical device 100.

[0032] Figure 2 shows a drive circuit 136 for turning on the light sources 108 and 110 in a part of the structure of the partitioning circuit 106.

(Writing Data)

The clock signal and the horizontal synchronization signal, which are the input signals, are inputted into the image data partitioning part 138 and the enable generator part 140. The image data and the image data partitioning position data are inputted into the image data partitioning part 138, and this image data partitioning part 138 has a function that is the image data de-assertion means according to Claim 3 of the present invention.

[0033] The [structure is such that the] image data is partitioned into partitioned image data A and partitioned image data B by this image data partitioning part 138, which are stored in the memory part A 143 and the memory part B 145.

[0034] Said enable generator part 140 is connected to the address specification parts 144 and 146. The enable signal A is outputted from the enable generator part 140 to said address specification part 144 and said memory part A 143. [The structure is such that the] the write address A to the memory part A 143 is specified by the address specification part 144.

[0035] Furthermore, the enable signal B is outputted from the enable generator part 140 to the address specification part 146, and to the memory part B 145. [The structure is such that] the write address B to the memory part B 145 is specified by the address specification part 146.

[0036] Between the enable signal A and the enable signal B there is a part wherein the memory interval overlaps, where, in this overlapping part, it is fundamentally possible to record the image data in both the memory part A 143 and the memory part B 145.

[0037] Figure 4 shows a detailed structure of the image data partitioning part 138.

[0038] The horizontal synchronization signal and the clock signal are inputted into a counter circuit 160, where the counter value is sent to the comparator 162 according to the range of one primary scan. In this comparator 162, the counter value is inputted based on the image data partitioning position information established in advance, in a structure wherein the comparator output is inverted, with a specific counter value as the boundary.

[0039] Here the output of the comparator 162 is inputted into one of the input terminals of AND circuits 166, directly into one [input terminal] and via an inverter circuit 164 into the other [input terminal].

[0040] These AND circuits 166 are connected, respectively, to the input terminals of the memory part A 143 and the memory part B 145. Furthermore, the image data is inputted into the other input terminals of these AND circuits 166.

[0041] The result is that, when the output of the AND circuit on the side wherein there is actually no image data outputted (in other words, the low level (zero) output side of the AND circuit 166), a dummy signal is outputted as the non-emission signal for the light source 108 (or 110).

[0042]
(Data Readout System)

As shown in Figure 2, the readout clock signal and horizontal synchronization signal are inputted into the enable generator part 148. This enable generator part 148 is connected to the address specification part 150, which specifies the readout address of the partitioned image data A, stored in the memory part A 143, and is connected to the address specification part 152, for specifying the readout address of the partitioned image data B, stored in the memory part B 145. In addition, the enable signal C is outputted from the enable generator part 148 to the address specification part 150, and the memory part A 143, and the enable signal D is outputted from the enable generator part 148 to the address specification part 152 and the memory part B 145.

[0043] These enable signals C and D are outputted based on the timing for adjusting the shift in the primary scan correction after the mechanical adjustments by the optical system, and in order to align the positions in the primary scan direction of the one primary scan line, the [enable signal C and the enable signal D] are adjusted and outputted for each individual primary scan line.

[0044] In the address specification parts 150 and 152, the row address is increased or decreased by a simple secondary scan direction position control system, not shown, to correct for shift in the secondary scan direction in advance, regardless of the change in the partitioning position or the extent of said change, and here only the column address need be considered. Note that in the memory part A 143 and the memory part B 145, there need only be enough capacity for the amount of the shift in the secondary scan direction (which, in the conventional technology, is the amount of shift after the mechanical adjustments have been performed, which is several lines worth).

[0045] Note that Figure 5 shows an example of where the memory part A 143 and the memory part B 145 have three lines worth of memory capacity. In this Figure 4 [sic], the FIFO's (A1, A2, A3) are the memory part A 143, which stores [the image data] for each line, and the FIFO's (B1, B2, B3) are the memory part B 145, which stores [the image data] for each line.

(Output System)

The memory part A 143 is connected to a laser diode driver 154 for turning on the light source 108, where the signal is outputted to this laser diode driver 156 [sic] based on the input of the signal from the aforementioned address specification part 150 and the input of the enable signal C, causing the light source 108 to turn on with a specific timing.

[0046] On the other hand, the memory part B 145 is connected to a laser diode driver 156 for turning on the light source 110, where a signal is outputted to this laser diode driver 156 based on the signal inputted from the aforementioned address specification part 152, and the input of the enable signal C, turning on the light source 110 with a specific timing.

[0047] The time chart in Figure 3 will be used below to explain the operation of the 1st example embodiment of the present invention.

[0048] The image data is partitioned and stored into the memory part A 143 and the memory part B 145 based on the partitioning location according to the image data partitioning location data. At this time, in this first form of embodiment, [the structure is such that] the data is stored in the addresses in the memory part A 143 and the memory part B 145 as specified by the address specification part 144 and the address specification part 146 the and thus, even when there is no output from the AND circuits 166 and 166, this non-output data, or in other words, the dummy signals so that the light sources 108 and 110 will be turned off, are stored [in memory].

[0049] As a result of the above, even though the beams emitted from the two light sources 108 and 110 are, in practice, not completely separate from each other, so that there is overlapping in the scan, in this overlapped region, one or the other will always be a dummy signal, and thus there is no effect on the image.

[0050] In the memory part A 143, the storage of the partitioned image data A begins with the input of the enable signal A. Here a dummy signal is stored during the interval between the when storage of the partitioned image data A to the memory part A 143 stops and when the enable signal A is de-asserted.

[0051] On the other hand, in the memory part B 145, the storage of the partitioned image data B is started based on the image of the enable signal B and the image data partitioning signal. In other words, the dummy signal is recorded during the interval between the output of the enable signal B and the switching of the image data partitioning signal, and, as a result, a dummy signal is stored in the memory part B 145 during the interval between the start of the storage of the partitioned image data B to the memory part A 143 [sic] and the start of storage of the partitioned image data B to the memory part B 145.

[0052] In this way, in the overlapping region, a dummy signal is stored in the memory part (B 145 or A 143) that is not the memory part (A 143 or B 145) that stores the actual image data, and thus there is no remainder of the previous image data and no storage of any new extraneous image data, and the image data is continuous with precision at the partitioning location, without any gaps or redundancy.

[0053] When the image data is partitioned and stored in the memory part A 143 and the memory part B 145, the enable generator part 148 of the readout system outputs the enable signal C to the address specification part 250 and the memory part A 143 based on the horizontal synchronization signal and the clock signal.

[0054] Furthermore, nearly simultaneously with this, the enable generator part 148 outputs the enable signal D to the address specification part 152 in the memory part B [145].

[0055] Here, because the row addresses are increased or decreased in the address specification parts 150 and 152 based on the shift in the secondary scan direction, the shift in the secondary scan direction will be eliminated, even if [the signals] are outputted simultaneously.

[0056] In this way, inserting a dummy signal in the overlapping region in the first example embodiment makes it possible to always partition at the same partitioning location (insofar as control is concerned), depending on the amount of the dummy signal inserted, even if adjustments are made in the addresses in the column direction and even if the partitioning locations are changed for each line, making it possible to simplify the control system. Additionally, the adjustments in the secondary scan direction are simplified as well, making circuitry for, for example, feedback systems unnecessary.

[0057] Next, a different example of the image partitioning part 138 will be described. Note that, when it comes to the structural components that are the same as in Figure 2, the same signals are attached, and the descriptions of these structures are omitted.

[0058] Figure 6 shows an image data partitioning part 138 wherein the partitioning timing of the image data can be changed with any desired timing in each individual scan.

[0059] In other words, the image signal partitioning position data, stored in advance, is outputted to the comparator 162 by the image data partitioning position data memory part 170, depending on the output of a counter 168, which counts the horizontal synchronization signals.

[0060] This comparator 162 outputs the comparison results of the output from the counter 160, which counts the number of clock signals, after the horizontal synchronization signal has been inputted, to the output of the image data partitioning position data memory part 170.

[0061] Logical ANDs are performed on the output of the comparator 162 and the image data (in AND circuits 166 and 166), generating the partitioned image data A and the partitioned image data B.

[0062] Note that although the structure is one wherein the image data partitioning position information is stored in advance in the image data partitioning position memory part 170, there might, instead, be a structure wherein the image data partitioning position is calculated depending on the image data.

Next, Figure 7 will show a structure for retrieving the light source non-emission signals from the image data and partitioning using the position of the light source non-emission signals as the boundaries.

[0063] As is shown in Figure 7, the output from the comparator 172, which compares the count value of the counter 160, which counts the number of clock signals since the horizontal synchronization signal, and the value of the counter 160 [sic] and the specific value for the partitioning region specification, and outputs [a signal indicating] the start of the overlapping region wherein the image data can be partitioned, and the output of a comparator 174, which detects the light source non-emission signal in the data, are subjected to a logical AND calculation (AND circuit 176), where the result is inputted into a one-shot trigger 178, which is reset with each horizontal synchronization signal.

[0064] In the one-shot trigger 178, the output value switches with the image data corresponding to the light source non-emission signal that is inputted initially by the image data during the overlap region.

[0065] By taking a logical AND (in the AND circuit 180) of the output of the one-shot trigger 178 and the output of the comparator 162, which outputs the image data partitioning position, the image data partitioning position is determined by whichever of the outputs is outputted first. [sic] Note that the image data is inputted to the AND circuits 166 and 166 through a D flip-flop circuit 182, providing synchronization with the signal from the AND circuit 180.

(Second Example Embodiment)

A second example embodiment of the present invention will be explained below. In this second example embodiment, a structure that can simplify the first example embodiment is shown, a structure that is effective for images wherein there need the only little variation in the partitioning positions.

[0066] Figure 8 shows a drive circuit 136 for turning on the light sources 108 and 110, which structure a part of the partitioning circuit 106.

(Data Writing System)

The clock signal and horizontal synchronization signal, which are the input signals, are each inputted into the image data partitioning part 138 A, the enable generator part 140, and a memory operation enable generator part 142, as the memory operation switching means described in Claim 4. The image data is also inputted into the image data partitioning part 138 A, where this image data is partitioned into partitioned image data A and partitioned image data B by this image data partitioning part 138 A, where this partitioned image data A and partitioned image data B are stored, respectively, in a memory part A and the memory part B.

[0067] An enable signal E is outputted to the address specification part 144, for specifying the write address to the memory part A 143, from the aforementioned enable generator part 140, and an enable signal F is outputted to the address specification part 146, for specifying the write address to the memory part B 145, by the aforementioned enable generator part 140. An overlap part is provided between this enable signal E and this enable signal F, where, in his overlap part, it is fundamentally possible to store image information to both the memory part A 143 and the memory part B 145.

[0068] Furthermore, [the structure is such that] an enable signal A is outputted to the memory part A 143 from the memory operation enable generator part 142, and an enable signal B is outputted to the memory part B 145 from the memory operation enable generator part 142.

[0069] The point in time wherein the enable signal A from the memory operation enable generator part 142 switches to the enable signal B is, essentially, the partitioning position of the image data.

[0070] Consequently, this is the same as the state wherein the light source 108 has an OFF signal, with no image signal stored in the address is wherein no enable signal A is inputted in, for example, the memory part A 143. Note that when the partitioning position changes for each single primary scan line (or for each multiple primary scan lines), one can consider the case wherein previous image data remains in the addresses wherein new image data has not been recorded, and thus, in the image part A 143, those addresses wherein the enable signal A has not been inputted must be overwritten specifically with OFF signals for the light source 108, and in the memory part B 145, those addresses wherein the enable signal B has not been inputted must be overwritten specifically with the OFF signals for the light source 110.

(Data Readout System)

The readout clock signal and horizontal synchronization signal are inputted into the enable generator part 148. This enable generator part 148 is connected to the address specification part 150, which specifies the readout address for the partitioned image data A stored in the memory part A 143, and also connected to the address specification part 152, which specifies the readout address for the partitioned image data B stored in the memory part B 145. Furthermore, the enable signal C is outputted from the enable generator part 148 to the address specification part 150 and the memory part A 143, and the enable signal B [sic] is outputted from the address specification part 152 to the memory part B 145.

[0071] These enable signal C and enable signal D are outputted based on the timing for adjusting the shift in the primary scan direction after the mechanical adjustments in the optics system to align the positions in the memory scan direction of one primary scan line. Note the structure is such that adjustments are made and outputted for each individual primary scan line.

[0072] Increasing or decreasing the column address in the address specification part 150 and 152 corrects for shift in the secondary scan direction, where, in this case, data pertaining to the shift in the secondary scan direction is inputted from a circuit that is not shown. Consequently,

in the memory part A and the memory part B, the capacity of the memory need only be adequate for the amount of shift in the secondary scan direction (which, in the conventional technology, is the amount of shift after making adjustments mechanically, which is several lines worth).

(Output System)

The memory part A is connected to a laser diode driver 154 for turning ON the light source 108, where a signal is sent to this laser diode driver 156 [sic] based on the signal from the aforementioned address specification part 150 and the input from the enable signal C, turning ON the light source 108 with a specific timing.

[0073] On the other hand, the memory part B 145 is connected to a laser diode driver 156 for turning on the light source 110, where, based on the signal from the aforementioned address specification part 152 and on the input of the enable signal C, a signal is outputted to this laser diode driver 156, turning on the light source 110 with a specific timing.

[0074] The timing chart in Figure 9 will be used below to explain the operation of this second form of embodiment of the present invention.

[0075] The image data is inputted into the image data partitioning part 138 A and partitioned into partitioned image data A and partitioned image data B. At this time, the partitioning is in a specific position in the primary scan, based on the horizontal synchronization signal and the clock signal, which are added to the image data. This partitioning position may be a constant position, but, in general, it is preferable to have [said position] changed each primary scan or each several primary scans so that the partitioning positions will not be noticeable.

[0076] Although the partitioned image data A is stored in the memory part A 143 and the partitioned image data B is stored in the memory part B 145, this memory timing is controlled by an enable generator part 140 and the memory operation enable generator part 142.

[0077] In other words, the write addresses to the memory part A and the memory part B are determined based on the enable signal E and the enable signal F that are outputted from the enable generator part 140. These write addresses have a region that overlap each other, and thus do not specify a partitioning position, where, if there is this overlapping region, the partitioning position can be determined by either.

[0078] The image data partitioning signal is inputted into the memory operation enable generator part 142, causing the enable signal A and the enable signal B to be outputted alternating between the memory part A 143 and the memory part B 145. Here the enable signal A is outputted first, and when the output of the enable signal A has been completed, the enable signal B is outputted.

[0079] In the memory part A 143, the storage of the partitioned image data A begins based on the input of the enable signal A. In this case, nothing is stored during the interval from the write address being specified by the address specification part 144 until the input of the enable signal A, corresponding to an OFF signal for the light source 108. However, if the partitioning position in one cycle is different from the partitioning position in the previous cycle, the old image data may still remain. Because of this, it is necessary to overwrite the addresses corresponding to the aforementioned interval with signals to turn OFF the light source 108.

[0080] When the storage of the partitioned image data A to the memory part A 143 has been completed, then, at essentially the precise moment, the storage of the partitioned image data B to the memory part B [145] is started by the input of the enable signal B. At this time, nothing is written during the interval between the specification of the write address by the address specification part 146 and the input of the enable signal B, corresponding to an OFF signal for the light source 110. However, if the partitioning position in one cycle is different from the partitioning position in the previous cycle, the image data from the previous cycle may remain. Because of this, it is necessary to overwrite the addresses corresponding to the aforementioned interval with signals to turn the light source 110 OFF.

[0081] Note that the overriding of the aforementioned off signals is a necessary if the partitioning positions moved diagonally towards the lower left from the first-line until the last line (that is to say, the partitioning position gradually advances), making this second example embodiment of the present invention unnecessary.

[0082] When the image data is partitioned and stored in the memory part A 143 and the memory part B 145, the readout enable generator part 148 outputs the enable signal C to the address specification part 250 and to the memory part A 143 based on the horizontal synchronization signal and the clock signal.

[0083] Furthermore, the enable generator part 148 outputs the enable signal D to the address specification part 152 and to the memory part B at essentially the same time.

[0084] Here, in the address specification parts 150 and 152, the row addresses are increased or decreased based on the shift in the secondary scan direction, thus eliminating the shift in the secondary scan direction, even if both are outputted simultaneously.

[0085] On the other hand, because, when it comes to the position in the primary scan direction, the timing is determined by the region corresponding to the light source OFF signal when writing, the time at which the enable signal A and the enable signal B are outputted may be simultaneous.

[0086] As described above, given the second example embodiment of the present invention, when the addresses at which the partitioned image data A and the partitioned image data B are stored into the memory part A 143 and the memory part B 145 are determined by the address specification part 144 and the address specification part 146, an overlapping region is provided in the two addresses, and the enable signal A and the enable signal B from the memory operation enable generator part 142 establish the write intervals, or in other words, establish the partitioning position. Because of this, the region specified by the address specification part 144, wherein the enable signal A is not inputted corresponds, essentially, to an OFF signal for the light source 108. In addition, the region specified by the address specification part 146, wherein the enable signal B is not outputted, corresponds, fundamentally, to an OFF signal for the light source 110. Consequently, even if this OFF signal is outputted, there is no impact whatsoever on the other side, and thus even if the partitioning position changes, it is not necessary to change the write address at that time, simplifying the circuit structure.

[0087]
[Effect of the Invention]
As described above, the partitioned image scanning optical device according to the present invention has a superior effect of making it possible to correct for the shift in location of the partitioned scan lines in the secondary scan direction, and possible to change the image data partitioning positions, doing so with a simple circuit structure.

[Simple Explanation of Drawings]

[Figure 1] A schematic drawing of a partitioned scanning optical device according to a first example embodiment of the present invention.

[Figure 2] A block diagram of the light source driver circuit used in a partitioned scanning optical device according to the first example embodiment of the present invention.

[Figure 3] A timing chart for the light source driver circuit of the partitioned scanning optical device according to a first example embodiment of the present invention.

[Figure 4] A detailed structural diagram of the image data partitioning part that outputs the dummy signal.

[Figure 5] A block diagram of the case wherein a line memory is used for the memory part.

[Figure 6] A detailed structural drawing of an image data partitioning part wherein the image data partitioning position can be changed with each scan.

[Figure 7] A detailed structural drawing of an image data partitioning part wherein the image data partitioning can be done using a light source non-emission signal.

[Figure 8] A block diagram of the light source driver circuit used in a partitioned scanning optical system according to a second example embodiment of the present invention.

[Figure 9] A timing chart for the light source driver circuit for the partitioned scanning optical device according to a second example embodiment of the present invention.

[Figure 10] A timing chart showing the relationship in the positional shift of the partitioned scan line and the image write out timing.

[Explanation of Codes]

(First Example Embodiment)

100: Partitioned scanning optical device
108, 110: Light sources
132, 134: Partitioned scan lines
138: Image data partitioning part (Image data non-assertion means)
140: Enable signal generator part (Image data non-assertion means)
142: Memory operation enable generator part
144, 146: Address generator parts
143: Memory part A
145: Memory part B
160: Counter
162: Comparator
164: Inverter circuit
166: AND circuit
170: Image data partitioning position data memory part

(Second Example Embodiment)

138 A: Image data partitioning part (Memory operation switching means)
140: Enable generator part (Memory operation switching means)

142: Memory operation enable generator part (Memory operation switching means)

[Name of Document] Drawings

[Fig. 1]
[see source for figure on 1/10]

[Fig. 2]
[see source for figure on 2/10]
1: Clock
2: Horizontal synchronization signal
3: Image data
4: Image data partitioning position data
138: Image data partitioning part
140: Enable generator part
144: Address specification part
146: Address specification part
5: Write address A
6: Partitioned image data A
143: Memory part A
7: Read address A
8: Partitioned image data B
9: Write address B
145: Memory part B
10: Write address B
150: Address specification part
152: Address specification part
148: Enable generator part
11: Horizontal synchronization signal
12: Readout clock
108: Light source
110: Light source

[Fig. 3]

[see source for figure on 3/10]
1: Horizontal synchronization signal
2: Image data partitioning signal
3: Image data

[Fig. 4]

[see source for figure on 4/10]

1: Image data partitioning position data
2: Horizontal synchronization signal
3: Clock
4: Image data
5: Partitioned image data A
6: Partitioned image data B

[Figure 5]

[see source for figure on 5/10]

1: Clock
2: Horizontal synchronization signal
3: Image data
4: Petitioned image data A
5: Image data partitioning position data
138: Image data partitioning part
6: Partitioned image data B
7: Readout clock
8: Position correction data
9: Decoder
108: Light source
110: Light source

[Fig. 6]

[see source for figure on 6/10]

1: Horizontal synchronization signal
2: Clock
3: Image data
170: Image data partitioning position data memory part
4: Partitioned image data A
5: Partitioned image data B

[Fig. 7]

[see source for figure on 7/10]
1: Image data partitioning position data
2: Horizontal synchronization signal
3: Clock
4: Partitioned region specification constant value
5: Image data
6: Light source non-emission signal value
7: Horizontal synchronization signal
178: One-shot trigger
8: Petitioned image data A
9: Partitioned image data B

[Fig. 8]

[see source for figure on 8/10
1: Clock
2: Horizontal synchronization signal
3: Image data
138 A: image data partitioning part
4: Partitioned image data A
5: Partitioned image data B
6: Read address A
150: Address specification part
148: Enable generator part
7: Horizontal synchronization signal
8: Readout clock
140: Enable generator part

144: Address specification part
146: Address specification part
142 Memory operation enable generator part
9: Read address A
10: Read address B
143: Memory part A
108: Light source
145: Memory part B
110: Light source
11: Read address B
150: Address specification part
152: Address specification part
148: Enable generator part

[Fig. 9]

[see source for figure on 9/10]

1: Horizontal synchronization signal
2: Image data partitioning signal
3: Image data

[Fig. 10]

[see source for figure on 10/10]

1: Partitioned scan line A 14
2: Positional shift in the direction of the secondary scan line (three lines)
3: Overlapping region
4: Partitioned scan line B 15
5: Direction of movement of the photosensitive element
6: Horizontal synchronization signal
7: Partitioned image data A
8: Partitioned image data B
9: Image data 1-A
10: Image data 2-A
11: image data 1-B
12: Image data 2-B
13: Image data 3-B
14: Image data 4-B
15: Image data 5-B

(Document type) Summary

(Summary)

(Subject) Correcting for positional shifts in the partitioned scan lines in the secondary scanning direction and changing the image data via a simple circuit structure.

(Solution procedure) The partition position was made to set based on image data partition position data, establishing overlapping regions when address specification parts 144 and 146 determine the address that stores image data A and B in memory parts A and B. To this end, in memory parts other than those where image is stored, a dummy signal that corresponds to the off-signal of light source 108 is stored. The dummy signals do not affect the other side of the overlapping region and even if the other side of the overlapping region and even if the partitioned data is altered, there is no need to adjust the writing address.

(Selected figures) Figure 2